

Missouri Resources

Summer 2014 • Volume 31 • Number 3

 **40
years**

Missouri Department of Natural Resources

director's comment

As the Missouri Department of Natural Resources celebrates its 40th anniversary this year, I have been reflecting on our many environmental accomplishments and achievements realized during the last four decades. These successes are reflected in improved air, land, water quality and soil resources. These achievements are also demonstrated through our nationally recognized Missouri State Parks system.

However, the story doesn't end there. It's also a story about the people. The department's role in protecting our state's natural and cultural resources is established in law as a reflection of the public will – that government should protect these resources (air, land, water, state parks, historic sites) in public trust for all Missourians, for all time.

It takes a truly impassioned person to care for and protect our outstanding natural resources. It's a quality that many of our department staff encompass, as well as people like you – our subscribers and many partners. This commitment comes from believing what many of us believe – that public service is a calling. We believe our work is serving a greater purpose – we are doing something for the common good. The commitment and dedication in the pursuit of environmental protection, historic preserva-



tion, natural history, preservation of unique ecosystems and providing experienced, knowledgeable input have helped enhance Missouri's abundant natural resources.

Above all, ensuring future generations have quality air, land, water and parks is something that will take the effort of more than just government – there's a role for all of us. As we pause to reflect on our many achievements, we hope you will join with us, as together, we reinvigorate our commitment toward protecting Missouri's natural and cultural resources.

While we've come a long way during the last 40 years, we know there is decidedly much more work to do. To learn more about the department's

40th anniversary, see the DNR 40 years article on page 10 in this issue of Missouri Resources, or visit the Web at dnr.mo.gov/40. As in the past, it is with your help and support that we will continue to work to provide all Missourians a healthy environment in which to live, work and enjoy the outdoors.

Sara Parker Pauley
Missouri Department of Natural Resources

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Mission Statement

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DNR photo by Andrew Richmond

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Above: An actor takes a break during the shooting of *The Battle of Island Mound* documentary.

Front Cover: Grand Gulf State Park in the Ozarks features a spectacular mile-long collapsed cave system. *DNR photos by Scott Myers.*

Back Cover: St. Francois State Park is a great place to log some miles for the Governor's 100 Missouri Miles Challenge.

Ready, Aim, Action!

New Documentary Tells Story of the Battle of Island

by Tom Uhlenbrock

photographs by Andrew Richmond



Director Brant Hadfield films an important shot for *The Battle of Island Mound* as members of the cast and crew watch from a distance.

BUTLER, Mo. – In terms of numbers, the fight was a skirmish. In terms of impact, the Battle of Island Mound changed the face of the Civil War.

Missouri State Parks, a division of the Missouri Department of Natural Resources, has released a new documentary movie titled, *The Battle of Island Mound*, that tells the dramatic story of the battle and explains its importance to Missouri and the rest of the country.

Fought in late October of 1862 on a plot of rolling prairie in Bates County, some 220 members of the First Kansas Colored Voluntary Infantry, most of them freed or escaped slaves, marched into Missouri to clear out a band of Southern-sympathizing guerrilla fighters.

Although outnumbered, the African-American Union soldiers routed the “bush-

Mound



whackers,” becoming the first black soldiers to fight under the Union flag in the Civil War. The battle made headlines as far away as New York City.

Allison Dubbert, a historian with Missouri State Parks, explained why the battle was a major victory for the Union, and a setback for the Confederacy.

“People did not think that former slaves would fight; they thought they would just run away,” Dubbert said. “Obviously, this battle proved that theory wrong. Nationally, they helped pave the way for blacks to be federal soldiers.

“Even the guerillas they fought against reported to the newspapers how hard they fought. They were fighting for their lives, and their freedom.”

The Battle of Island Mound State Historic Site was dedicated last year, becoming

Missouri’s newest state park facility. Located amid the soybean fields in a rural area west of Butler, the 40-acre site includes a short, scenic trail among sweeping prairie, with interpretative panels along the way.

“It’s peaceful, and pretty isolated if you want to be alone out in nature,” Dubbert said. “And it still has a sense of history. You get a feeling for what happened out there.”

Bill Bryan, director of state parks, attended the dedication ceremony along with several descendants of the members of the First Kansas Colored Volunteer Infantry who fought in the battle.

“It was one of the most powerful, emotional moments I ever witnessed,” Bryan said. “Some of the descendants literally collapsed onto their knees, they were so overcome with emotions and pride.

“The battle is a story of human spirit and

(Opposite page, top) Actors portraying members of the First Kansas Colored Voluntary Infantry relax as they wait for their next take while simultaneously creating a scene seemingly straight out of history.

(Top) Stunt Coordinator Mark Bedell trains cast members on how to “fight for the camera” before filming begins on “The Battle of Island Mound” documentary.



“The story, as great and important as it is, has been a secret – until now.” – Bill Bryan, Director, Missouri State Parks

(Above) During filming, all actors were trained on the proper way to load and fire Civil War-era rifles. They also learned how to form a line and affix a bayonet, creating a realistic impression of what the historic battle may have been like.

(Right) Bill Bryan, director of Missouri State Parks, and Andrea Cook (far left), a descendant of a First Kansas Colored Voluntary Infantry member, meet with students at Ruskin High School after the premier showing of the film.



people rising above hardship and doing what was thought to be impossible – and changing the course of human history,” Bryan said. “We decided a movie was the best way to reach a wider audience and let people know about this event.

“The story, as great and important as it is, has been a secret – until now.”

Ready to Fight for Old Glory

The 20-minute documentary, which will be shown in parks and historic sites, as well as libraries, schools and non-profit organi-

zations that request it, was produced by St. Louisan Brant Hadfield of Motionpath Productions. *The Battle of Island Mound* was filmed in Missouri state parks. Some of the actors used in the film were students at Central High School in Springfield.

The story is based on the oral history as told by the late Jimmy Johnson, a descendant of George Washington, who fought at Island Mound. Filmed in sepia tones to give it a sense of history, an older actor, Clyde Ruffin, plays the role of Washington and retells the battle to a younger relative.

“I put my mark by my name, and I was a First Kansas Colored soldier, young and damn proud,” he said. “I wasn’t somebody’s property any more. I was a free man. We were ready to fight for Old Glory. We knew we could die, but we were never going back into slavery.”

The film re-enacts how the black troops commandeered a farmstead owned by Southern sympathizers, and called it “Fort Africa.” The troops eventually were lured from their camp into a rebel trap, and the two sides met on a low hill known as Island Mound.

The black soldiers faced their foes on horseback armed with shotguns, pistols and sabers. They fought back, using bayonets and the butts of their rifles. The guerillas set fire to the tall-grass prairie as a smoke-screen, but the Union troops succeeded in driving them back into a marshy area known as Hog Island. When reinforcements arrived from Kansas the next day, the guerillas were gone.

Eight members of the First Kansas were killed and 11 wounded. Southern losses were not known, but were thought to be about the same.

“Something was changed that day at Island Mound,” the actor said. “We showed we were worth something, we were free, we were men and we were never going back,” Ruffin added.

A Year Before *Glory*

Lt. Richard Hinton, a white officer with the First Kansas Colored Volunteer Infantry, wrote of the historic battle: “We have demonstrated that the Negro is anxious to serve his country, himself and race; that he can be drilled and made effective as a soldier; and that he will fight as well as any other set of men.”

President Lincoln signed the Emancipation Proclamation months after the Battle of Island Mound, making it legal for blacks to join the Union and serve as officers. The First Kansas had two black officers, including one who fought in the battle, but they were denied their commissions when they were federalized.

The 1989 movie *Glory* received



praise for telling the story of the 54th Massachusetts Volunteer Infantry, which the movie depicted as the first all-African-American unit of the U.S. Army to face combat. While the First Kansas was mustered into the Army later as a federalized force, the Battle of Island Mound marks the first time African-American troops were engaged in Civil War combat, nearly a year before the battle depicted in the film *Glory*.

To reach Battle of Island Mound State Historic Site, take Highway 52 west from Butler, and go south on Route K to the park signs. 🐾



Tom Uhlenbrock is a staff writer for Missouri State Parks, a division of DNR.

(Above) Actors run into position during filming. This scene depicted the moment when the First Kansas soldiers stood their ground against the advancing rebels.

(Below) Small sections of Prairie State Park were set afire for a controlled burn that also served as a backdrop for the film. Park staff are trained to handle controlled burns, a regular maintenance task in some parks.





Where Does the Water Go

... and how do we know?

by Jerry Prewett

photographs by Scott Myers

Cecil Boswell and Bill Duley of the Missouri Geological Survey replace a dye collector and take measurements of water discharging from the upper outlet of Greer Spring in Oregon County.

For 40 years, the Missouri Department of Natural Resources has upheld the Missouri Clean Water Law by conserving, protecting, maintaining, and improving the quality of water in the state. The work is paying off and today citizens enjoy the cleanest and highest quality water in Missouri in decades.

Geologists with the department's Missouri Geological Survey play an important role in supporting these efforts, and we

often hear stories from citizens about lakes and rivers beneath the "Show-Me State." In fact, when I was a young boy growing up in the Ozarks, I heard stories filled with accounts of incredible waterways that originated in faraway places. I remember fantasizing about those subterranean waterways. It seemed obvious to me the well in our yard was tapping fresh water from one of those underground resources, which fueled my curiosity about how aquifers work.

As a geologist, I have explored caves. Underground exploration revealed natural cracks, crevices and conduits in the rock. Some of the openings were big enough to crawl through, but most were small and seemingly insignificant. I recall one common thread in these caves – water. They all contained water dripping or cascading from the rock, and most had cool spring water flowing along their main passageways and out of the cave mouths. Numerous questions came to mind. Where was all this water actually coming from?

Caves and springs play a huge role in transporting groundwater. To date, 6,037 caves and 6,080 springs have been documented in Missouri. Whether the topic is groundwater, surface water or rock formations and their composition and abundance, the area's geology and hydrology go hand-in-hand. Because Missouri's geology is mostly composed of porous sedimentary rocks like sandstone and fractured limestone and dolomite, it is capable of storing a lot of groundwater. Much of the state continues to enjoy an abundance of fresh, drinkable groundwater.

Missouri citizens currently draw from more than 150,000 private water wells. Municipalities and businesses in the state operate more than 4,300 public wells, some supplying as much as 2 million gallons of water each day.

In all, several billion gallons of groundwater are pumped from the state's geologic formations every year, and the demand will likely increase. We use groundwater for drinking, food production, cleaning, cooling, heating, manufacturing and recreation.

Protection of groundwater resources hinges on our understanding of aquifers and many scientific methods of investigation are used to define the characteristics of groundwater aquifers.

One method involves an activity known as water tracing. This is one tool the department uses to improve our understanding of how groundwater behaves in those subsurface environments.

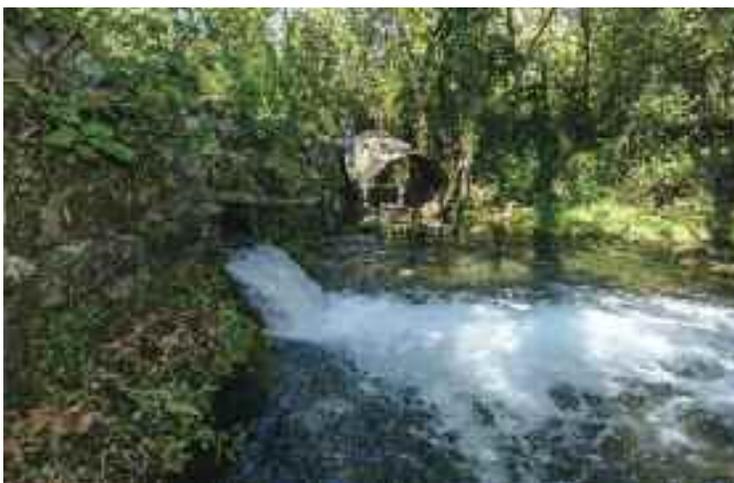
To execute a water trace, non-toxic fluorescent tracing dye is placed at a location where water flows underground. Possible recovery locations, such as springs, are monitored where the dye may resurface. Recovery of the tracer proves that it has moved through the geologic formations below the ground to that location. From this information, certain aquifer characteristics



Environmentally friendly dye is injected into the “sump” in Grand Gulf Cave at Grand Gulf State Park. This dye was later recovered at Mammoth Spring State Park in Arkansas, nearly 10 miles south.



(Above) The entrance to Grand Gulf Cave is often flooded, restricting access to the cave's Jefferson City dolomite tunnels. (Below) Much of the water that flows underground in the Alton, Mo. area resurfaces at the old mill dam at Boze Mill Float Camp.



are documented to help determine how vulnerable an aquifer may be to activities on the surface.

Early water-tracing techniques offered questionable results. Tracers such as straw, wheat chaff, feathers, plant spores, and chemical tracers such as salt were once used. However, each posed unique problems that made tracing difficult or caused water supplies to be temporarily unusable. The introduction of fluorescent dyes provided a safe and effective alternative to these methods, but results were often uncertain because of the ambiguity of earlier detection methods.

“Today’s dyes can be diluted to concentrations unseen by the eye, but still detectable by specially designed equipment,” said Bill Duley, former assistant state geologist and deputy director of what is now the Missouri Geological Survey. “This allows for traces to be performed on large aquifer systems where groundwater travels many miles, while causing minimal impact.” Similar methods continue to be used worldwide.

The natural beauty of water is the central focus in many Missouri state parks and historic sites. Recently, the Missouri Geological Survey was instrumental in improving our scientific understanding of groundwater vulnerability in Missouri state parks and the Ozark National Scenic Riverways national park area. Water tracing conducted in and around Howell and Oregon counties and in Grand Gulf State Park demonstrated surface water can seep and flow into the ground and within a few days, travel more than 15 miles underground and resurface at major springs located in another county.

The underground network of cracks and conduits used for conveying water can be complex. It can be difficult to determine water’s exact travel path. But what we can be sure of is where the water went, how far it traveled, how quickly it moved, and what concentration of dye was recovered. This usually is enough information to determine what aquifer would be affected by a contaminant at the surface. With enough water traces, the recharge area for a spring can be closely defined. The recharge area is where water seeps into the ground through porous rock and replenishes aquifers. This type of testing has been done for Maramec Spring, in Phelps County, and Bennett Spring, in Dallas County, among other locations.



“Today’s dyes can be diluted to concentrations unseen by the eye, but still detectable by specially designed equipment. This allows for traces to be performed on large aquifer systems”

– Bill Duley, former assistant state geologist and deputy director, Missouri Geological Survey



(Top) Greer Spring in Oregon County pumps out approximately 220 million gallons of water every day. This nearly doubles the flow of the Eleven Point River when water from the spring finally reaches the river 1.4 miles away.

(Left) This dolomite passage at the natural bridge of Grand Gulf State Park is often filled with water after a heavy rainstorm.

Thanks in part to scientific methods like water tracing, DNR continues to conserve, protect, maintain and improve Missouri’s water resources through scientific analysis.

Advancing our understanding of the effects climate and human activity have on groundwater and water quantity is critical for providing clean water for another 40 years, and beyond.

Read more at dnr.mo.gov/geology/geosrv/envgeo/watertrace.htm.

The Missouri Geological Survey is a division of the Missouri Department of Natural Resources. 



Jerry Prewett is assistant state geologist and deputy director of the department’s Missouri Geological Survey.

dnr40years

1974 2014

by Andrea Balkenbush



Johnson's Shut-Ins State Park remains one of the jewels of the state park system, despite being nearly destroyed by a reservoir breach in 2005. All photos from DNR files

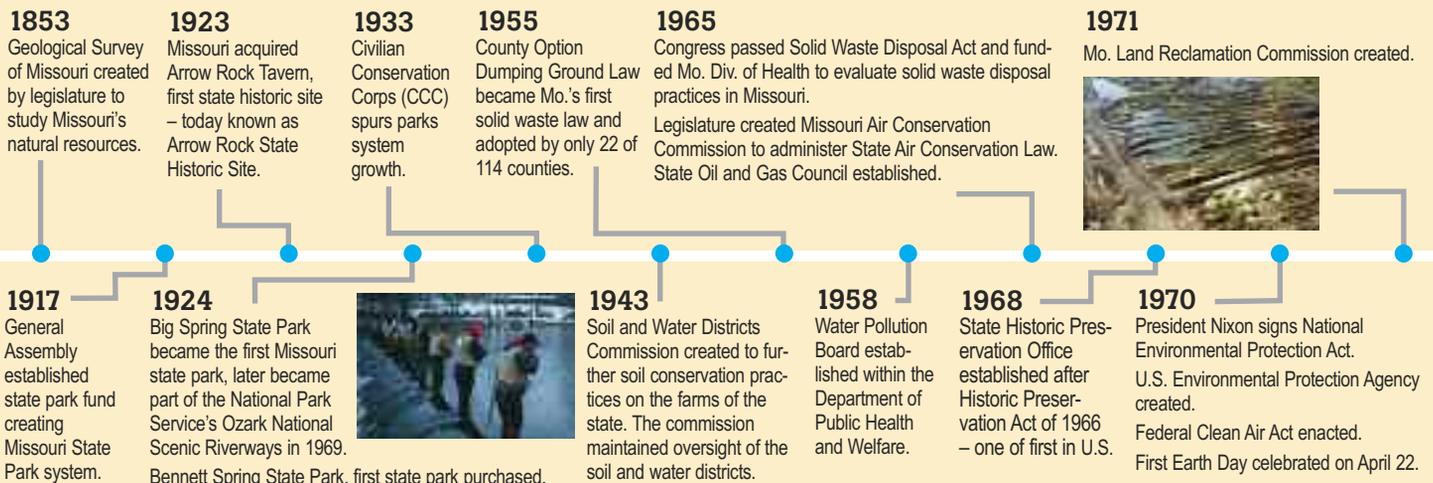
As we reflect on the 40th anniversary of the Missouri Department of Natural Resources, we must acknowledge the events that led to the creation of the federal Environmental Protection Agency, the first Earth Day and shortly after,

the establishment of this department. Sometimes, in order to understand and appreciate our history, we need to go back and refresh our memories of that era.

In 1969, Congress presented President Nixon with the National Environmental Policy Act (NEPA). The act had several purposes: to encourage productive and enjoyable harmony between man and his environment; promote efforts that prevent damage to the environment; stimulate the health and welfare of man; and enrich our understanding of the ecological systems and natural resources important to the nation. Gaylord Nelson, a U.S. senator from Wisconsin in 1969, called this early victory for our natural resources, "the most important piece of environmental legislation in our history."

The NEPA document established the Council on Environmental Quality (CEQ) which provided the president information on environmental matters. In the first CEQ Annual Report on Environmental Quality in 1970, the council wrote: "Historians may

Environmental Timeline 1853 - 1983





one day call 1970 the year of the environment – a turning point, a year when the quality of life [became] more than a phrase”

In President Nixon’s 1970 State of the Union Address, he suggested that he and Congress make “the 1970s a historic period when, by conscious choice, [we] transform our land into what we want it to become.”

That same year, our nation’s first Earth Day celebration took place in thousands of locations, signifying Americans’ will to make the necessary changes to better protect our natural resources, preserve our ecological systems, and be better stewards of our land, water and air. In 1971, the Environmental Protection Agency was created with a mission to establish and enforce environmental protection standards, conduct environmental re-

search, provide assistance to others combatting environmental pollution, and assist the CEQ in developing and recommending new policies to the president for environmental protection.

Not only was policy changing at the federal level, but Missouri was experiencing its own challenges during this time. Many Missouri communities lacked adequate drinking water, and more than 100 years of residual mining activity and hazardous waste dumping littered our landscape. In the early 1970s, smog from industrialization and an abundance of vehicles was so prevalent in St. Louis and Kansas City that citizens were encouraged to stay indoors at times.

Through these and other similar events, the people of Missouri and the General Assembly recognized the need to protect and preserve our natu-



(Above, left) An Environmental Emergency Response employee inspects barrels displaced during 2008 floods. (Above) The Taum Sauk Reservoir failure sent 1.3 billion gallons of water into Johnson’s Shut-Ins State Park.

ral resources. In 1974, the General Assembly created the Department of Natural Resources under the Omnibus State Reorganization Act. The strategic organization of the department brought together at least 14 existing entities with complementary missions that would be able to meet the tough natural resource challenges.

1974

DNR established under state reorganization on July 1, 1974; consolidated at least 14 previous state government agencies. James L. Wilson, DNR director 1974-1977.



Federal Safe Drinking Water Act enacted.

1976

Resource Conservation and Recovery Act and Toxic Substances Control Act enacted by Congress.

1978

Fred A. Lafser, DNR director 1978-1985. Missouri Land Reclamation Act enacted.

1980

Superfund Law (CERCLA) enacted.



1982

Federal Nuclear Waste Policy Act enacted. EPA detects dioxin contamination after a flood in Times Beach, Mo.

1972

Federal Clean Water Act passed to restore and maintain U.S. water quality. Mo. Clean Water Commission established. Mo. Solid Waste Management Law passed. State Environmental Improvement and Energy Resources Authority established.

1975

Mo. began addressing ozone issues in St. Louis and Kansas City.

1977

Carolyn M. Ashford, DNR director 1977-1978. U.S. Department of Energy established. Mo. Hazardous Waste Management Law and program created. Hazardous Waste Management Commission assigned to DNR’s Division of Environmental Quality. U.S. Surface Mining Control & Reclamation Act passed.

1979

Missouri Dam and Reservoir Safety Program established and related laws enacted. Missouri Surface Coal Mining Act enacted.

1983

HB 528 (the “Spill Bill”) passed, leading to creation of the Missouri Environmental Emergency Response Program. Major water consumers required to register and report use data.



A dye trace study is conducted to observe the movement of groundwater through a sinkhole.

In many ways, the department's family tree extends back to 1853 when the Geological Survey of Missouri was created by the legislature. This entity was commissioned to study Missouri's natural resources with the mandate of making a thorough geological and mineralogical survey of the state so we would know what was useful or valuable. Even 161 years later, mineral resources and

mining in our state are important natural resource protection issues and crucial to our economy.

In 1917, another significant and well-established branch of the department's family tree began when the General Assembly created the state park fund. This came after Missourians demanded the establishment of public lands for future generations. The creation of our state park system is a rich part of our state's heritage. Missouri State Parks' mission to preserve and interpret the finest examples of Missouri's natural landscapes and cultural landmarks, and provide outdoor recreation opportunities was firmly established during these early years.

During the next 50-plus years, Missouri lawmakers passed critical laws and established entities that would ultimately lead to the formation of the Department of Natural Resources (see timeline).

Ponder for a moment what would have happened if our leaders and citizens hadn't taken the bold steps to enact the laws to protect our natural

resources. Could we imagine a nation without clean water, clean air or sustainable land to provide for us?

Even if we don't remember what it was like before our nation took these steps, we need only look to developing countries around the world to see that they are challenged by the same issues Missouri faced. As an industrialized nation we will always need to



Environmental Timeline 1984 - 2014

1984

Via Constitutional Amendment, Missouri voters adopted the Parks and Soils Sales Tax, a one-tenth-of-one-percent sales tax to provide funds for five years to the state park system and soil conservation efforts; first in the nation.

Underground Storage Tank Law enacted.

DNR identified sites with hazardous wastes on Missouri Registry.



1989

G. Tracy Mehan, DNR director 1989-1992.

Missouri Water Resources Law passed. Mo. Geological Survey opened McCracken Core Library.

1990

Senate Bill 530 created 20 Solid Waste Management regions, districts and plans.

1993

David A. Shorr, DNR director 1993-1997.

The great flood of 1993 covers mid-Mo. Missouri Mine Map Repository created. State Parks established ADA committee and spent \$6.5 million on 1,000 accessibility projects.

1985

Fredrick A. Brunner, Ph.D., PE, DNR director 1985-1989.

1986

Water Well Drillers Act established; Well Installation Board created. Federal Emergency Planning and Community Right-to-Know acts enacted.

1987

State Revolving Fund Program established in Mo.

1988

Missouri voters renewed Parks and Soils Sales Tax - approved by 2/3 of voters. Major Mo. oil spill when Shell Oil pipeline breaks on Christmas Eve. DNR responded to the spill of 863,000 gallons of crude oil into Gasconade River. EPA and DNR began environmental study on Lake Taneycomo area.



1991

Interstate Mining Compact Law enacted; Interstate Mining Compact Commission enacted.

1992

The Safe Drinking Water Commission established; assigned to DNR.

(Opposite page) Before cleanup, many illegal dump sites were filled with trash and other debris such as used tires.

(Below) Crews work to clean up an oil spill on Little Turkey Creek on Nov. 5, 1990. The spill polluted the Chariton River.



safeguard our natural resources. Advances in science and technology will continue to help us all be better stewards of our natural resources and meet future challenges. Because Missourians value their natural resources and the quality of life they provide, the Department of Natural Resources continues to fulfill its mission with broad public support.

The department is fortunate to work for a citizenry that is an active partner in our mission. Whether you're a family that regularly camps and recreates in the outdoors, participates in

Stream Team cleanups and water quality monitoring, or works for one of the many organizations across the state that supports DNR's mission, each of us can conserve, protect, enhance or educate our citizens about our natural resources. Our success depends on continued collaboration.

With your continued help, the Department of Natural Resources will work to provide all Missourians a healthy place to live, work and enjoy the great outdoors. 

Andrea Balkenbush is chief of planning for the Department of Natural Resources.



The annual Katy Trail Ride, a five-day day bike ride, brings large numbers of visitors from around the U.S. to many towns along the Katy Trail.

1994

Geologists Registration Act enacted.
EPA launched its Brownfields Program.
The state Voluntary Cleanup Program created within the DNR Hazardous Waste Program.
President Clinton issued executive order for Environmental Justice on Feb. 16.



2009

Mark N. Templeton, DNR director 2009-2010.
President Obama signed the American Reinvestment and Recovery Act.



2010

Sara Parker Pauley, DNR director 2010-present.
Gov. Nixon launched State Park Youth Corps.

2011

DNR responded to devastating tornadoes and storms in Joplin and surrounding areas.
DNR begins Our Missouri Waters initiative.

1997

Times Beach cleanup completed; became Route 66 State Park.

1998

Stephen M. Mahfood, DNR director 1998-2004.
Mo. Clandestine Drug Lab Collection Program created.
17,000-acre Weldon Spring cleanup completed (site of hazardous World War II materials.)
EPA and DNR agree to control and clean up lead contamination in Herculaneum.

2005

Doyle Childers, DNR director 2005-2009.
AmerenUE Taum Sauk Reservoir breached, releasing 1.3 billion gallons of water.

2006

Missouri voters renewed Parks and Soils Sales Tax by the highest percentage to date (70.8).
DNR creates e-cycle Missouri, a framework for disposing, reusing and recycling e-scrap.

2007

Gateway Vehicle Inspection Program began.

2012

ePermitting program established.
Drought Assistance Pgm. initiated/completed.

2013

DNR reinvigorated its compliance assistance efforts; expanded community services efforts.
DNR launched online map of hazardous waste sites in Mo.
DNR and Columbia Public Schools announced partnership to develop Nature School.

2014

GeoSTRAT launched – for easy public access to geologic and hydrologic data.

COAL MINER'S WATER

by Mike Mueller and Van Beydler



DNR photo by Mike Mueller

These barren and eroding acid spoil piles have been left since coal mining in Callaway County ceased in the 1950s.

During the 1940s, the Jennings and Crowson Co. near Millersburg mined several small tracts of land in western Callaway County. The company produced coal that fueled electric plants and heated homes. In the more than a half century that followed the end of the mining, the 40 acres of abandoned mine lands produced nothing but safety concerns and threats to human health and the environment.

During the time the mine was active, there were no rules requiring the company to protect the environment or reclaim the land. As a result, much of the mined area was scarred with rugged terrain that was difficult to cross on foot and impossible to

traverse in a vehicle. Several of the ponds found on-site contained acidic water unable to support aquatic life.

“This site is located within a designated flood plain that is very poorly vegetated and has exposed acid-producing spoils (excavated soil) eroding into Miller’s Creek,” said Amanda Lowe, a former environmental specialist with the Missouri Department of Natural Resources. “The areas were barren for more than 60 years. It was obvious the sites were extremely eroded, based on the sediments identified in Miller’s Creek prior to reclamation. Accelerated erosion and extreme spoil acidity inhibited plant establishment on the barren land.”



DNR photo by Renee Bungart



During summer 2013, the abandoned mine land unit of the department's Land Reclamation Program began a project to reclaim some of the worst areas affecting Miller's Creek.

"The ponds were releasing acidic water into Miller's Creek during heavy storms, so it was important to eliminate those," Lowe said. "The reclamation work is also expected to improve water quality in Miller's Creek by reducing the amount of acid-forming sediments that erode into the stream."

Contractors hired and overseen by the department graded down the large barren piles, backfilled the dangerous high wall and stabilized eroded areas through grading

and the planting of ground cover.

The reclamation project consisted of grading approximately 200,000 cubic yards of acidic coal-mined waste to a gentle slope. Throughout the grading process, the acidic soils were treated with more than 3,100 tons of agricultural lime. Approximately 72,000 cubic yards of non-toxic cover material from other locations at the sites were spread over the reclaimed area to cover the acidic subsoils and promote successful revegetation. Nearly 1,650 tons of rock were used for permanent erosion control and the resurfacing of access roads.

Following grading, approximately 15 acres were seeded with perennial cool-sea-

(Above left) Part of the Miller's Creek reclamation efforts involved treating the acidic soil with sub-alkaline lime to neutralize ground-water that runs downstream from the site.

(Above) Piles of acidic coal-mined material required treatment of the toxins in the waste. Later, 72,000 cubic yards of fresh cover material were brought in to spread over the reclaimed area.

DNR photo by Mike Mueller



DNR photo by Renee Bungart

Acid-forming sediments were washing from low-lying areas and entering Miller's Creek prior to the 2013 reclamation project near Millersburg in western Callaway County.

money is distributed to individual states to address health, safety and environmental problems traditionally associated with abandoned coal mines.

Missouri currently receives approximately \$3 million per year from this fund. Sites that pose the greatest dangers are reclaimed first.

Although this money is primarily spent to address the issues related to abandoned coal mines, it also is available for reclaiming extremely dangerous abandoned non-coal mine problems, such as lead and zinc mine shafts.

There are approximately 66,000 acres of mine lands that were abandoned in Missouri prior to 1977, the year the current reclamation law went into effect.

Of those, 4,638 acres have been reclaimed and 9,753 acres show some need of reclamation. The remaining acres are well-vegetated areas that were affected by coal mining, but do not require reclamation to address health, safety or environmental concerns.

Reclamation projects occur on both public and private lands. The Millersburg project not only improved water quality, but returned previously useless areas back into production for Lonnie Giboney, one of the

son grass and legumes. The remaining 35 acres were seeded with a temporary cover crop of wheat to stabilize the site and prevent short-term erosion.

This and similar reclamation projects are funded through the federal Abandoned Coal Mine Reclamation Fund. Money in this fund comes from a fee collected by the U.S. Department of Interior's Office of Surface Mining on every ton of coal produced by active coal mines throughout the U.S. This



DO YOU HAVE A MAP OF AN UNDERGROUND MINE?

The department's Missouri Geological Survey is interested in borrowing maps individuals may have of underground coal mines in Missouri for entry into the Missouri Mine Map Repository for the purposes of public safety and protection of property. Loaned maps are scanned, entered into the archive and returned to their owners.

Learn more at dnr.mo.gov/geology/geosrv/geores/minemaps.htm.



DNR photo by Andrew Richmond

landowners involved in the reclamation of the area.

“[The project] has eliminated several contaminated water pits that were completely unusable by our cattle,” Giboney said. “And the reclaimed land will be more productive for both our livestock operation and local wildlife.”

Bringing these areas back to a stable and natural state is the Missouri Department of Natural Resources’ goal.

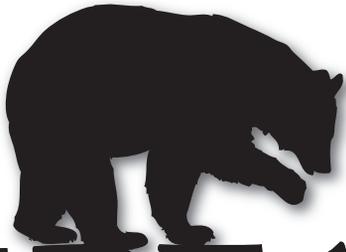
The restoration of beneficial ecosystems can improve the health of streams, create habitat for animals and return land damaged by surface mining to productive use. 🐾

Mike Mueller is an environmental specialist in the department’s Land Reclamation Program. Van Beydler is a public information coordinator serving the Land Reclamation Program.

(Top) An “after” view of the page 14 photo illustrates the leveling of the spoil piles and the planting of ground cover. Lime applied during grading neutralized the acidic soils. **(Right)** Eroding spoil piles along Miller’s Creek once contributed to acid sediments found in water samples.



DNR photo by Renee Bungart



BE BEAR AWARE

by Tom Uhlenbrock

A wild animal largely missing from Missouri's woods for nearly a century is making a comeback, and Missouri State Parks is preparing for its return.

Black bears are on the increase, especially in the Ozark forests south of the Missouri River. Recorded sightings include several in state parks, including Roaring River, Meramec, Table Rock, Grand Gulf and Johnson's Shut-Ins state parks.

Ken McCarty, chief, Natural Resource Management Section, is finalizing details for a Be Bear Aware program and education campaign aimed at preparing parks, staff and visitors for the time when bears might become much more frequent in state parks.

"Bears increasingly are going to be a part of the park environment as the years go by," McCarty said. "We know from other bear states that bear problems are much easier to prevent, than to try and stop. We want visitors and staff to have a positive experience all the way around, without issues and problems that could be avoided with advance planning."

That planning includes limiting the lures that draw the secretive animals into areas where they may conflict with humans.

"A big part of the bear interaction comes down to managing trash – how do we exclude bears from compost stations and trash dumpsters?" said McCarty. "We will phase in new approaches, such as bear-resistant dumpsters, bear-proof food boxes in group camps, emptying trash cans before nightfall and fencing fish composting stations.



DNR photo by Andrew Richmond

(Above and page 19, bottom) Heather Danforth, an interpreter at Ha Ha Tonka State Park, displays a bear pelt and skull that are used during interpretive programs.

"For visitors, especially campers, state park rangers will inform people about bears and especially how to manage food and food storage in the campground. We may install bear boxes or bear poles for food storage."

Parks that request them can receive "bear trunks" containing hands-on materials including a full bear pelt with

souri may have had a remnant population of its own. That's good news because the larger the gene pool, the healthier the resulting populations.

The Missouri Department of Conservation estimates there now are as many as 300 bears in Missouri, including females that are reproducing in the state. Biologists point out that the success of the bear recovery is an indicator that Missouri forests also have returned to a healthy state after nearly two centuries of over-cutting.

Secretive and Cautious

Although the primary food of bears is plant matter, including acorns in the fall, bears also eat insects, small mammals and carrion. They are secretive and cautious by nature and rarely approach humans, but can be drawn into areas by food, causing potential problems. It is illegal to kill a bear in Missouri, unless the bear is perceived to be a threat.

While they avoid contact with people, bears have a keen sense of smell and may view dog bowls, bird feeders, bee hives, trash cans or a greasy camp grill as a treat. That's where the Be Bear Aware program is important.

Positive Encounters

McCarty, who is coordinating the effort to implement the bear awareness program, said the word will be spread through state park rangers and hosts, social media, online, informational brochures and printed information at parks, especially in areas where black bear populations are growing.

"We're hoping to have a message that it's exciting that state parks have a big enough backcountry area to be a factor in the re-emergence of bears in Missouri," he said. "We want our visitors to be as excited as we are."

"That's why we're preparing the public so encounters with bears can be positive instead of negative. That way both the bears and the park visitors benefit." 



Tom Uhlenbrock is a staff writer for Missouri State Parks, a division of the Missouri Department of Natural Resources.



DNR photo by Andrew Richmond



DNR photo by Scott Myers

Park visitors may notice "Bear Aware" signs along trails if a bear has been known to frequent the area.

head and claws, scat replica and molds of the tracks of young and adult bears. The plan is to help park naturalists provide bear-related programs, especially in parks where bears are more likely to be encountered.

Steve Bost, the naturalist at Montauk State Park near Salem, said bears have left ample evidence of their presence, and have been photographed on nearby trail cameras. Visitors are more comfortable with the possible presence of bears after attending one of the park programs, he said.

"With something like bears or mountain lions or elk, the lack of knowledge can cause fear in people," Bost said. "We talk about bear biology, what they eat; we have a video that shows baby bears in a den."

"The woods are an empty place without the wildlife. Anytime we see an increase in animals' numbers, it adds a whole new level of enjoyment to the forest. It's great to have a place to go and know those animals are still there."

Healthy Forests Welcome Bears

When the first settlers arrived in Missouri, black bears were abundant in every county and were the second most commonly killed game animal after white-tailed deer. But by the 1930s, bears were thought to be eliminated from the state due to loss of habitat and over-hunting.

Arkansas had seen its bear numbers dwindle and began a re-stocking program in the 1950s with bears from northern states. Those bears now number in the thousands, and Arkansas bears wandered across the border into Missouri and began building populations in the neighboring state.

A recent genetic study had a surprising result. Data showed that not all the bears in Missouri could be traced back to the northern transplants in Arkansas, meaning Mis-

2014 State Parks Youth Corps

A nationally recognized jobs initiative for young adults is returning for its fifth year, Gov. Jay Nixon announced

THINK OUTSIDE STATE PARKS YOUTH CORPS

this spring. The State Parks Youth Corps, launched by the governor in 2010, provides Missouri youth with the opportunity to work outdoors improving Missouri's state parks and historic sites. Eligible Missourians between the ages of 17 and 23 can apply to work at parks, historic sites and natural areas across Missouri, from May 1 through Dec. 31. Applications for the SPYC program are now being accepted online at thinkoutside.mo.gov. State Parks Youth Corps is administered by Missouri's Workforce Invest-

ment Boards in partnership with the Missouri Department of Economic Development's Division of Workforce Development, and Missouri State Parks. In 2013, the Missouri State Parks Youth Corps program was accepted as a part of the 21st Century Conservation Service Corps.

"Show Me the Fair" Exhibit On Display at State Historic Site

Visitors can enjoy "Show Me the Fair: Souvenirs and Remembrances of the 1904 World's Fair," the Missouri State Museum's new exhibit in the Rozier Gallery at Jefferson Landing State Historic Site. Sponsored by Missouri State Parks, the exhibit will showcase selections of the museum's extensive collection of St. Louis World's Fair memorabilia. The exhibit will run through Aug. 30. The 1904 World's Fair ran from April 30 to Dec. 1.

To remember their trip to the 1,200-acre fair, visitors bought and brought home all sorts of keepsakes.

Visitors will get a look at the trinkets and tales of the fair through the photographs, quotes and mementos on display. The Elizabeth Rozier Gallery is located in the Union Hotel at Jefferson Landing State Historic Site, 101 Jefferson St., Jefferson City. The gallery is open from 10 a.m. to 4 p.m., Tuesday through Saturday.

Permit Modifications List Available Online

Facilities or businesses that actively treat, store – for longer than 90 days – or dispose of hazardous waste in Missouri must get a hazardous waste permit that lists how and what kinds of hazardous waste the facility is allowed



Time Exposures

Traditionally, the opening of trout season has been a March 1st mainstay for anglers across our state. For photographer Robert Szabo, aside from fishing, opening day is also a great opportunity to take out his camera and document the festival of fish.

This photo was taken by Szabo on opening day in 1974 at Bennett Spring State Park. The Easter Seals poster girl is getting a fishing lesson from Virgil Ward, who at the time was one of the nation's best-known fishermen, due to his syndicated fishing show.

Ward once owned a plumbing shop in Amsterdam, Mo., in the 1950s. He and his brother Bill started the Bass Buster Lure Co. out of the back of his shop, which later led to a radio show dedicated to fishing that was broadcast on more than 200 stations. He also wrote a widely known newspaper column on fishing, and in 1964 began his foray into television. The *Virgil Ward Championship Fishing Show* was a nationally syndicated show dedicated to fishing trips not only in the U.S., but abroad. Ward, who won many national and world fishing championships, often asked celebrity guests to join him.

Ward stopped doing the show approximately 10 years before succumbing cancer in 2004. According to his obituary, he went out fishing on the lake behind his home in Amsterdam just a few weeks before his death at the age of 93.

Send your photo to "Time Exposures," c/o Missouri Resources, PO Box 176, Jefferson City, MO 65102-0176. Original photos will be returned via insured mail. Pre-1980 environmental and natural resource photos from Missouri will be considered. Please try to include the date and location of the picture, a brief description and any related historic details that may be of interest to our readers.



Photo courtesy Robert Szabo

to manage. It also contains the facility's operating conditions and closure, corrective action and financial assurance requirements.

The Department of Natural Resources or the facility can make changes to the hazardous waste permit throughout its life. The regulations label facility-initiated permit modifications as Class 1, 2 or 3, depending on how much they change the original permit conditions. The department is inviting the public to review the list of all approved hazardous waste permit modifications for calendar year 2013. The permit modifications list is online at dnr.mo.gov/env/hwp/permits/publications.htm.

For more information or a hard copy of the list, contact the department's Hazardous Waste Program, Permits Section, at 800-361-4827. Hearing- and speech-impaired individuals may reach the department through Relay Missouri at 800-735-2966.

GeoSTRAT Tool Makes Online Debut

Looking for springs, mines or sinkholes? GeoSTRAT can be used to locate those and much more, using an interactive map.



In early 2014, the Department of Natural Resources' Missouri Geological Survey launched GeoSTRAT, the Geosciences Technical Resource Assessment Tool. This tool makes geologic and hydrologic data available to citizens, city planners, industry representatives, academia and others online, 24/7.

An internet connection, a Web browser and the free Google Earth plug-in are needed to operate the search application.

GeoSTRAT also can be used for data assessments in various disciplines such as hazards assessment, environmental consulting and engineering, local and regional planning, insurance assessment and others. Data also can be downloaded in formats

OUR MISSOURI WATERS



Steve Anderson photo

Volunteers clean up tires and other solid waste on the Big River in east-central Missouri.

While introducing the Department of Natural Resources' Our Missouri Waters effort during the past two years, those attending often ask, "What is Our Missouri Waters?" The more revealing question might be, "Who is Our Missouri Waters?" There are many people across Missouri who already work to protect, preserve and en-

hance our water resources. Each day, drinking water operators in small towns think about ways to stop leaks, save water and protect their neighbors' drinking water from all sorts of pollutants. Local citizens gather to remove litter from a stream or plant vegetation along its banks to prevent stream bank erosion. The truth is: We are all Our Missouri Waters. The department cannot unilaterally protect, preserve and enhance our water resources. It takes committed local citizens, passionate advocates and technical expertise to create the long-term vision and plan needed to fulfill that lofty mission.

DNR is excited to join with Missourians as we continue the Our Missouri Waters effort and work cooperatively to ensure clean and abundant water for generations to come!



compatible with a variety of free and commercial mapping software.

Give it try! Visit dnr.mo.gov/geology/geostat.htm and proceed to GeoSTRAT.

Perennial Winner Takes Missouri Envirothon

Pembroke Hill High School from Kansas City took the top score in the 2014 Missouri Envirothon.



The 18-team competition took place on

May 1 at the Audrain County 4-H Center in Mexico, Mo.

Students competed at five different outdoor testing stations – aquatic ecology, forestry, soils and land use, wildlife and the 2014 current conservation issue, "Sustainable Local Agriculture/Locally Grown." Test stations

required teams to complete a variety of both hands-on and written natural resource questions. Each team also was scored on an oral presentation to a panel of judges.

The winning team from Missouri's competition will move on to a regional competition in early August in Illinois at which the top three teams will be eligible for scholarship awards.

In 2015, Missouri will host the national Envirothon at Missouri State University in Springfield from July 27 to Aug. 2.

For news releases on the Web, visit dnr.mo.gov/newsrel.

For a complete listing of the department's upcoming meetings, hearings and events, visit the department's online calendar at dnr.mo.gov/calendar/search.do.

Looking for a job in natural resources? Go to dnr.mo.gov/hr.

Top Spots to Kayak



DNR photos by Scott Myers

There's no better way to escape the heat than spending a day on a kayak or canoe. Four Missouri state parks offer boat rentals for visitors who want to explore the Ozark's pristine floating streams. Canoes and kayaks also can be rented at several parks for use on lakes within or bordering the park.

Sam A. Baker, Bennett Spring, Meramec, and Washington state parks have floating opportunities on waterways that range from adventurous to relaxing. Whether enjoying a gentle family float on the Meramec River or taking the opportunity to enjoy high water at Big Creek in Sam A. Baker State Park, there is plenty to enjoy.

Many parks offer kayak rentals to enjoy lakes at the park. Crowder, Cuivre River, Finger Lakes State Park, Lake

Wappapello, Lake of the Ozarks, Pomme de Terre, Stockton, Thousand Hills and Wakonda state parks have opportunities for water recreation. At Finger Lakes, Stockton and Lake of the Ozarks state parks, make sure to check out the water trails to learn more about the sites one can see by boat.

Never kayaked before? Check out the Learn2 Paddle programs available in Missouri State Parks. The program teaches participants how to paddle and have a safe enjoyable time on the water.

Visit mostateparks.com to learn more and register for a class.

(Clockwise from top) You can traverse 6.65 miles of shoreline on the Stockton State Park Water Trail.

Paddlers pass a Lakeside Trail overlook at Cuivre River State Park. You can land your kayak near the park's lakeside campgrounds at Pomme de Terre State Park.



1000 Steps Trail

photograph by Scott Myers

In Washington State Park, visitors can enjoy both nature and history on the 1.5-mile 1000 Steps Trail. This trail is a remarkable example of the outstanding rock work completed at Washington State Park during the 1930s by the Civilian Conservation Corps. In 1936, the CCC's Company 1743 constructed the trail using the large stone steps that gave 1000 Steps Trail its name. After climbing the stone steps through the oak and hickory hardwood woodland, hikers will encounter more of the CCC's handiwork – an overlook shelter built into the hillside to resemble a natural

outcropping. This stone shelter overlooks the Big River valley and makes a nice resting place after the long climb up the slope.

Hiking along this unique trail, visitors may see many of nature's wonders, including colorful wildflowers, native songbirds, squirrels and other small mammals, majestic hardwood trees and abundant dolomite rock outcroppings.

The 1000 Steps Trail also meanders through the 68-acre Washington State Park Hardwood Natural Area, an area of land set aside for protection because of its exceptional natural beauty.



Rock Matters



Rare Earth Elements

Rare earth elements are used in many devices and products people use every day, including: cell phones, DVDs, rechargeable batteries, catalytic converters and fluorescent lighting, to name a few. Some are classified by the U.S. Geological Survey as strategic and critical to the United States.

(Left) These rare earth oxides are used as tracers to determine which parts of a watershed are eroding. USDA photo by Peggy Greb. (Bottom) This crystal of xenotime contains rare earth elements such as yttrium – important for green technologies and defense applications. DNR photo by Cheryl Seeger.

Naturally occurring metal elements known as rare earth elements are often called “rare earths.” They are considered rare not because they are not abundant, but because it is unusual to find them in economically recoverable concentrations.

Rare earths have important and diverse properties that include magnetic, optical, chemical, electrical, catalytic, metallurgical and nuclear. Dysprosium, lanthanum and neodymium are used in today’s energy, medical and automotive industries. All three and nine other rare earths are found in southeast parts of Missouri.

Many are key ingredients in “green technology.” There is increasing demand for them for the manufacture of solar panel and energy-efficient lasers and automotive components. Large wind turbines need approximately 1,300 pounds of rare earth elements to work, including neodymium, praseodymium, dysprosium and terbium. Research includes the development of magnetic refrigeration that will reduce energy consumption and carbon emissions.

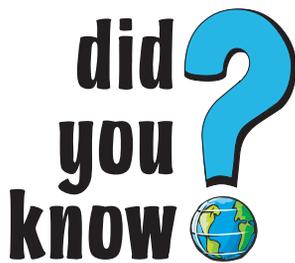
Some have every day uses, as well as uses important to national defense. Samarium is needed in headphones as well as for stealth technology and precision guided weapons. Yttrium is important for defense laser systems and weapons. Neodymium is used in the manufacture of welder’s goggles, telescopes, laser range finders and guidance systems.

Rechargeable lanthanum nickel-hydride (NiMH) batteries are used in hybrid vehicles and in “AA” and similar size batteries because they offer long battery life and have fewer disposal issues. Rare earths are used in computer memory, fiber optic cables, and for the purification of water. Erbium is used to color glass pink and is required for fiber-optic data transmission.

From 1948 to 1990, most of the world’s rare earths came from India. Since 1990, the world has depended on China for these critical elements.

USGS reported that rare earths were mined by one company in the U.S. in 2013, at Mountain Pass, Calif. According to USGS, the U.S. continued to be a major consumer, exporter and importer of rare earth products in 2013. The estimated value of refined rare earths imported by the U.S. in 2013 was \$260 million. Rare earths have an annual global impact in the billions of dollars.

The rare earths present in Missouri could prove to be strategic to the U.S. Department of Defense. Geologists with the Missouri Geological Survey, USGS and other experts continue to evaluate rock core samples and characterize the rare earths present below the surface in Missouri to determine their potential.



Illegal Disposal of Solid Waste is a Class D Felony

Litter is an unsightly mess that is not only an eyesore, but also can be a health hazard. Dumpsites provide a home for pests and serve as a breeding ground for their young. Some items, like old tires, refrigerators and construction waste, also can be toxic to the environment. Whether you call it refuse, litter or garbage, it is illegal to dump solid waste on public lands, private lands or waterways in the state of Missouri.

The Missouri Department of Natural Resources’ Solid Waste Management Program uses surveillance cameras to monitor dumpsites across the state to combat illegal dumping. If caught illegally disposing of solid waste, an offender faces a Class D felony conviction and fines of \$20,000 or higher. Littering also is a Class A misdemeanor and offenders face fines of up to \$1,000 per incident and may be imprisoned in the county jail for up to one year.

The best way to avoid trouble with the law when dealing with trash is to utilize the numerous options available. Instead of dumping your items in an illegal location, use a commercial trash service or take items to a permitted landfill, transfer station or recycling facility. If you are unsure of how to properly dispose of a particular item, contact the department’s Solid Waste Management Program at 800-361-4827 or 573-751-5401, or visit dnr.mo.gov/env/swmp/index.html. To file an online report of illegal dumping, visit dnr.mo.gov/concern.htm.



A Plan for the Future

by Van Beydler photograph by Scott Myers



An aerial view east of Sedalia in Pettis County shows a tapestry of soil conservation practices at work.

For the past 30 years, a portion of the parks, soils and water sales tax has been used for Missouri landowners to install soil and water conservation practices through the state cost-share program. These practices conserve soil, which improves water quality by reducing sedimentation in rivers and streams. They also protect water quality by reducing polluted stormwater runoff that enters our waterways. The nationally recognized parks, soils and water sales tax has been overwhelmingly supported by Missouri voters during the past 30 years.

The Soil and Water Conservation Program is updating its Plan for the Future under the direction of the Soil and Water Districts Commission. This document is used to guide program activities in the coming years, working with the 114 soil and water conservation districts which administer the program at the county level. The last plan was completed in 2005, and much has changed in how we do business since that time. As agriculture

uses more technology, the program needs to adapt to take advantage of these changes.

The new plan will address the following areas: outreach and education, current cost-share practices, soil and water conservation district operations and delivery, and emerging issues. Involving those who will be affected by the plan is critical. Many organizations, partner agencies, and district employees and supervisors have been involved in formulating the plan.

At a December 2013 Missouri Association of Soil and Water Conservation Districts training conference, each subcommittee reported on the proposed plan and requested districts' feedback. Subcommittees continue to receive input from stakeholders about local concerns and how those concerns impact a statewide plan for conservation practices and their delivery.

The document will be available for public comment before the commission considers adopting it. Periodic updates about different portions of the

plan have been provided to the commission at their meetings.

"Commissioner Gaw and I were in a discussion group with some local district board members and it was really good to see them there," said Soil and Water Districts Commission chair Gary Vandiver. "It is so important they are encouraged to come and give their opinions, and the board members and staff present were outstanding."

"Another thing that impressed me is they are truly interested in our purpose," said commission vice-chair H. Ralph Gaw. "It comes right down to saving soil, making sure our water systems are good and receiving suggestions about how to obtain nutrient reduction," Gaw concluded.

Van Beydler is the information officer for the Soil and Water Conservation Program. Colleen Meredith and Ken Struempf assisted with this article. Meredith is the SWCP director and Struempf is an environmental engineer in the program.

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Where will you get *your* 100 miles?

The Governor's 100 Missouri Miles Challenge encourages Missourians to complete "100 Missouri Miles" of physical activity by walking, running, biking, rolling, paddling or hiking throughout Missouri, including Missouri's state parks and historic sites. Join Gov. Jay Nixon and First Lady Georganne Nixon as they get out and get active in 2014. To sign up for the 100 Missouri Miles Challenge and begin logging miles, or to continue an existing account, visit 100MissouriMiles.com.

